



# 1-23 HYDRAULIC AND HYDROLOGIC DATA

## Overview

Early and accurate project scope of work is essential for successful projects. To achieve this, continuous communication between the Bridge Design Offices of the Division of Engineering Services (DES- Structure Design), and the Capital Outlay Support – Hydrology and Hydraulics Branch (DES-Structure Design Services & Earthquake Engineering) regarding hydrologic, hydraulic and scour issues is needed.

This memo defines the roles and responsibilities of the Project Engineer and the Structure Hydraulics Engineer in establishing and maintaining communication throughout the development of the project.

## Request for Hydraulic and Hydrologic Information

*Requests for hydraulic information for all waterway crossings should be sent to:*

(NAME), Branch Chief

Structures Hydraulic Engineer

DES – Capital Outlay Support - Hydrology and Hydraulics Branch, Office of Structure Design Services & Earthquake Engineering, MS-9 HYD

cc: Branch Hydraulic Contact

*A copy of the request should be sent to:*

(NAME), Project Coordination Engineer

DES – Program/Project & Resource Management

(NAME), Office Chief

Structure Design

*Only at the APS stage a copy of the request should be sent to:*

(NAME), Technical Liaison Engineer  
Structure Design

## Hydraulic Reports

For waterway crossing projects, close communication needs to be maintained between Structure Design and Structure Hydraulics throughout the project. There are two Hydraulic Reports that are generally required.

- Preliminary Hydraulic Report - Planning Phase
- Final Hydraulic Report - Design Phase

The following describes the information provided by Structure Design and Structure Hydraulics during the planning and design phases. It should be noted that the following is a guide and should not preclude any additional communication necessary on a specific project to maintain the scope, cost and schedule.

## Preliminary Hydraulic Report (PHR) - Planning Phase

Upon receiving an APS request from the District, Structure Design is to submit a request for a Preliminary Hydraulic Report (PHR) to the Structure Hydraulics Engineer.

*Required from Structure Design for each waterway crossing within the project:*

- Location and scope of work
- Date information is needed – typically 4 weeks. The timeframe may be negotiated with Structure Design depending upon the complexity of the waterway and number of structures within the project as well as urgency of information.
- As-built plans (General and Foundation Plans, Pier and Abutment detail sheets and LOTB as a minimum).
- Typical section of bridge and proposed channel geometry
- Special (unusual) design considerations

- Utility conflicts or issues
- Foundation information (if available)
- District request memo with District contact names (Project Engineer and Project Manager)

*Information to be provided by Structure Hydraulics:*

The preliminary evaluation does not necessarily have to be a thorough hydraulic study, but must be detailed enough so the proper structure type(s) can be identified by Structure Design.

The Preliminary Hydraulics Report (PHR) will include a checklist of comments regarding:

- Hydraulic problems or issues (drift, degradation, aggradation, migration, etc...)
- Pier/foundation type recommendation
- Suggested soffit elevation utilizing a 0.6-meter minimum vertical freeboard
- High water elevation
- Allowable freeboard
- Flow rates (50, 100-year and record)
- WSEL (50, 100-year and record)
- Minimum span length
- Preliminary total scour depth
- Current scour rating (NBIS Item 113 code and definition)
- Hydraulic skew

## Final Hydraulic Report (FHR) - Design Phase

Upon receiving the Bridge Site Submittal documents from the District, Structure Design is to submit a request for a Final Hydraulic Report (FHR) to the Structure Hydraulics Engineer. This report is requested and prepared during the PS&E stage of the project.

*Required from Structure Design for each waterway crossing within the project:*

- Copy of the APS
- Date information is needed - typically 8 weeks, entered into eSSOP. The timeframe may be negotiated with Structure Design depending upon the complexity of the waterway and the number of structures within the project as well as the urgency of information.
- Bridge Site Submittal package

*If available, the General Plan and Foundation Plan should also be forwarded along with request.*

At this time Structure Hydraulics may contact either Preliminary Investigations or District Surveys to schedule channel surveys upstream and downstream of the bridge site if necessary. Communication at this juncture is imperative because it impacts Structure Hydraulics as well as Preliminary Investigation or District Survey schedules. Only after receipt of the survey information can an in-depth hydraulic analysis be undertaken.

*Information to be provided by Structure Hydraulics:*

The Final Hydraulic Report will be prepared in accordance with Section 1.3

“Waterways,” of the **Bridge Design Specifications** and shall include, but not limited to, the following:

- The State assigned Bridge Name(s), Bridge Number(s), location(s) and other pertinent information for the applicable structures
- A brief history and description of the hydrology
- Comments on constraints or requirements which influence selection of available alternatives
- A Hydrologic Summary table, which specifies data on the basin area, frequency, discharge, and associated water surface elevations at the bridge for the Design Flood, Base Flood and Overtopping Flood/Flood of Record.
- Final recommendations on hydrologic, hydraulic and scour issues (recommendations for span length, pier type, minimum soffit elevation, etc)

The following guidelines are used in the preparation of the Final Hydraulic Report:

- Design for the flood having a two percent (2%) chance of being exceeded in any given year (designation Q50) or the flood-of-record, the greater of which shall be designated as the “design flood”.
- Adequate freeboard should be provided above the design flood to pass anticipated drift. A site-specific drift evaluation must be performed to determine the horizontal and vertical drift way requirements.
- Convey a flood having a one percent (1%) chance of being exceeded in any given year (base flood designation Q100). No freeboard is added to the base flood.
- Total Scour is calculated based upon the cumulative effects of the long-term scour, general (contraction) scour and local scour. The life expectancy of the bridge should be considered in determining the total degradation or aggradation of the waterway. Long-term scour is based on an assumed 75-year term for new construction projects.
- The hydraulic recommendations are independent of the use of slope protection, debris racks, energy dissipaters, or other measures to protect the structures.

The Design Engineer shall consider the following:

- Bridge foundations should not fail due to scour from a base flood (Q100).
- Footings supported on soil or degradable rock strata should be embedded below the maximum computed scour depth or protected with a scour countermeasure. Footings supported on massive, competent rock formations, which are highly resistant to scour, should be placed directly on the cleaned rock surface.
- Footings on piles may be located above the lowest anticipated scour level provided the piles are designed for this condition.

The Project Engineer from Structure Design shall invite the Structure Hydraulic Engineer to the Type Selection meeting to respond to hydraulic questions that may arise.

Upon completion of the Final Hydraulic Report, the Project Engineer shall provide a copy of the report to the Resident Engineer Pending File for use in the construction phase of the project.

## Final Project Review Meeting

At PS&E, the Project Engineer from Structure Design should arrange a Project Review meeting. The following representatives shall be invited: Design Engineer, Construction Engineer, Geotechnical Engineer, Specification Engineer and the Structure Hydraulic Engineer. The purpose of this meeting is to perform a final review for hydraulic and geologic issues and verify the information on the plans and in the specifications.

*The Project Engineer shall provide:*

- Structure Plans and Special Provisions
- As-Built Plans (if existing structure)
- Final Foundation Report
- Final Hydraulic Report

The Final Hydraulic Report will include a Hydrologic Summary table, which should be placed onto the Foundation Sheet of the contract plans.

A suggested format for the Hydrologic Summary table is shown:

HYDROLOGIC SUMMARY			
Drainage Area: ____ km <sup>2</sup>			
	Design Flood	Base Flood	Overtopping Flood/Flood of Record?
Frequency	50-yr	100-yr	____-yr / ____-yr
Discharge	____ m <sup>3</sup> /s	____ m <sup>3</sup> /s	____ m <sup>3</sup> /s
Water Surface Elevation at Bridge	____ m	____ m	____ m
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

*original signed by Rick Land*

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Richard D. Land  
Deputy Chief, Division of Engineering Services,  
Structure Design